

**TUV SUD BABT TCB**

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Date: **06/24/2015**

REF: **RF exposure analysis**

Model: **14119**                      FCC ID: **T4514119**                      IC: **6450A-14119**

This device is to be used only for mobile applications. This device also integrates a pre-certified 2G/3G WWAN module UL864-NAD (FCC ID: RI7UL865NA; IC: 5131A-UL865NA).

The antenna(s) used for this transmitter must be installed to provide a separation distance of at least 20 cm from all the persons and must not be co-located or operating in conjunction with any other antenna or transmitter except with the integrated pre-certified 2G/3G WWAN module UL864-NAD (FCC ID: RI7UL865NA; IC: 5131A-UL865NA) or under the conditions described KDB 447498 D01 General RF Exposure Guidance.

**MPE exposure limits**

The table below is excerpted from Table 1B of 47 CFR 1.1310 titled Limits for Maximum Permissible Exposure (MPE), Limits for General Population/Uncontrolled Exposure:

| Frequency Range (MHz) | Power density (mW/cm <sup>2</sup> ) | Averaging time (minutes) |
|-----------------------|-------------------------------------|--------------------------|
| 300 – 1500            | f (MHz) /1500                       | 30                       |
| 1500 – 100.000        | 1,0                                 | 30                       |

The table below is excerpted from RSS-102, Issue 5, 4, titled “Table 4: RF Field Strength Limits for Devices Used by the General Public (Uncontrolled Environment)”:

| Frequency Range (MHz) | Power density (W/m <sup>2</sup> ) | Averaging time (minutes) |
|-----------------------|-----------------------------------|--------------------------|
| 300-6000              | $0.02619 f^{0.6834}$              | 6                        |

**Maximum output power of pre-certified 2G/3G WWAN module UL864-NAD (FCC ID: RI7UL865NA; IC: 5131A-UL865NA)**

| Frequency band           | Max Output Power dBm | Tolerances |   |
|--------------------------|----------------------|------------|---|
|                          |                      | -          | + |
| <b>GSM/EDGE 850</b>      | 32.5                 | 1          | 1 |
| <b>GSM/EDGE 1900</b>     | 29.5                 | 1          | 1 |
| <b>WCDMA/HSPA FDD V</b>  | 23                   | 1.5        | 1 |
| <b>WCDMA/HSPA FDD II</b> | 23                   | 1.5        | 1 |

**RF exposure**

Using the equation  $S = \frac{PG}{4\pi R^2}$  to calculate the exposure to electromagnetic fields

where: S = power density (in appropriate units, e.g. mW/cm<sup>2</sup>)  
P = power input to the antenna (in appropriate units, e.g., mW)  
G = power gain of the antenna in the direction of interest relative to an isotropic radiator  
R = distance to the center of radiation of the antenna (appropriate units, e.g., cm)

compliance with FCC/IC MPE and EIRP limits is demonstrated following the calculations shown in the following page.



| 14119          |                       |                                          |                                                           |                                                    |                                                         |                                                 |                                     |                                    |                                                         |                                                 |                                     |                                    |                                    |                                           |
|----------------|-----------------------|------------------------------------------|-----------------------------------------------------------|----------------------------------------------------|---------------------------------------------------------|-------------------------------------------------|-------------------------------------|------------------------------------|---------------------------------------------------------|-------------------------------------------------|-------------------------------------|------------------------------------|------------------------------------|-------------------------------------------|
| Mode           | Frequency Range (MHz) | Reference frequency (Lowest freq.) (MHz) | Maximum field strength (45955RRF.001test report) (dBμV/m) | Equivalent EIRP (mW)                               | Evaluation distance for compliance with MPE limits (cm) | $S = \frac{PG}{4\pi R^2}$ (mW/cm <sup>2</sup> ) | FCC MPE limit (mW/cm <sup>2</sup> ) | IC MPE limit (mW/cm <sup>2</sup> ) | COMPLIANCE (S<S <sub>Limit</sub> )                      | RELATIVE EXPOSURE (S/S <sub>Limit</sub> )       |                                     |                                    |                                    |                                           |
| TPMS           | 433,92                | 433,9                                    | 72,71                                                     | 0,005596                                           | 20                                                      | 0,00000111                                      | 0,289                               | 0,166                              | COMPLIANT                                               | 0,0000067                                       |                                     |                                    |                                    |                                           |
| UL865-NAD      |                       |                                          |                                                           |                                                    |                                                         |                                                 |                                     |                                    |                                                         |                                                 |                                     |                                    |                                    |                                           |
| Frequency Band | Mode                  | Frequency Range (MHz)                    | Reference frequency (Lowest freq.) (MHz)                  | Maximum conducted output power (per tune-up) (dBm) | Multi-slot Class                                        | Maximum number of TX slots                      | Duty cycle (%)                      | Antenna gain (dBi)                 | Evaluation distance for compliance with MPE limits (cm) | $S = \frac{PG}{4\pi R^2}$ (mW/cm <sup>2</sup> ) | FCC MPE limit (mW/cm <sup>2</sup> ) | IC MPE limit (mW/cm <sup>2</sup> ) | COMPLIANCE (S<S <sub>Limit</sub> ) | RELATIVE EXPOSURE (S/S <sub>Limit</sub> ) |
| GSM 850        | GSM/GPRS/EDGE         | 824,2 - 848,2                            | 824,2                                                     | 33,50                                              | 10                                                      | 2                                               | 25%                                 | -0,53                              | 20                                                      | 0,099                                           | 0,549                               | 0,258                              | COMPLIANT                          | 0,3825762                                 |
| FDD V          | UMTS/HSPA             | 826,4 - 846,6                            | 826,4                                                     | 24,00                                              | N/A                                                     | N/A                                             | 100%                                | -0,53                              | 20                                                      | 0,044                                           | 0,551                               | 0,258                              | COMPLIANT                          | 0,1713905                                 |
| GSM 1900       | GSM/GPRS/EDGE         | 1850,2-1909,8                            | 1850,2                                                    | 30,50                                              | 10                                                      | 2                                               | 25%                                 | -0,43                              | 20                                                      | 0,051                                           | 1,000                               | 0,448                              | COMPLIANT                          | 0,1129061                                 |
| FDD II         | UMTS/HSPA             | 1852,4 - 1907,6                          | 1852,4                                                    | 24,00                                              | N/A                                                     | N/A                                             | 100%                                | -0,43                              | 20                                                      | 0,045                                           | 1,000                               | 0,448                              | COMPLIANT                          | 0,1010240                                 |

## Co-location evaluation

According to KDB 447498 D01 General RF Exposure Guidance v05r1, 7.2:

*Simultaneous transmission MPE test exclusion applies when the sum of the MPE ratios for all simultaneous transmitting antennas incorporated in a host device, based on calculated or measured field strengths or power density, is  $\leq 1.0$ .*

$$S_{14119}/S_{Limit} = 0,0000067$$

$$S_{UL865-NAD}/S_{Limit} = 0,3825762$$

$$S_{14119}/S_{Limit} + S_{UL865-NAD}/S_{Limit} = 0,0000067 + 0,3825762 = 0,3825829 < 1 \rightarrow \text{COMPLIANT}$$

If you have any doubt please do not hesitate to contact us.

Yours sincerely,

p.a.

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